croſs-bars paſſing through the ſtirrups, as in the aqueduct, and prevented from yielding ſideways, by the diagonal braces exhibited at A, B, &c. Fig. IV. After which, the whole may be covered with plates of iron, ſoiled and gravelled, or planked, and covered with earth and gravel in like manner.

Although, I conceive, there is little doubt but a bridge, as above deſcribed, would ſtand to the length of two or three hundred feet, yet the multiplicity of pieces of which it is compoſed, in order to preſerve the ſhape of the ſegment and relieve the butments, would evidently occaſion much labour and nicety of workmanſhip; therefore it exhibits the importance of ſimplifying ſuch works, in order to facilitate their formation, and apply every particle of materials, ſo that they may tend to ſtrengthen the whole, and not be liable to alter the poſition.

I ſhall therefore return to the firſt propoſal of adequate butments, to reſiſt the longitudenal preſſure of an arch of any dimenſions. In this it muſt be conſidered, that the butments need not be of the immenſe ſize which firſt ſtrikes the imagination; for whatever dimenſions an arch of iron or wood may be, the quantity of materials is eaſily calculated, and the weight which the butments will have to reſiſt; for inſtance, if an arch weighs five hundred tons, and the butments oppoſed to its preſſure weighs one thouſand tons, they conſequently cannot move, not to mention the weight of earth backing, which tends to render them more permanent; therefore, ſeeing that the foundations are ſecured, and the ſprings, if any, well drained, in order to keep them dry, I ſee no difficulty in conſtructing butments to ſupport an arch of any dimenſions, and that at much leſs expence than butments and piers could be erected for a ſtone bridge; in the ſame ſituation particularly, if ſuch piers were to be built in water of any conſiderable depth.

Having premiſed the butments to be of ſufficient ſtrength, I conſider the arch, whether it be compoſed of iron or wood, to be like the ſegment of a hogſhead, and the component parts as near as poſſible like the ſtaves: for this purpoſe, in conſtructing one of iron, Fig. VIII. repreſents two ſtaves, each of which might be caſt in open ſand, four feet broad from twelve to fifteen feet long, the pattern being formed to the radius of the ſpring, a flange on the lower ſide of the ſtave ſhould be caſt, about one foot broad, with holes to receive the ſcrew pins; acroſs the ſtave one or more ribs, if thought neceſſary, ſhould be caſt, to give ſtrength to the top plate; theſe ribs and flanges, in uniting the ſtaves would butt on each other, and ultimately compoſe a rib to the whole extent of the bridge.

Having caſt the ſtaves as wide and long as experience may hereafter prove expedient, I will ſuppoſe it neceſſary to erect a bridge one hundred feet ſpan, as in Fig. V.; in building the butments, it would be adviſeable to place two or three ſegments, of the ſame radius, as the bridge, in each butment, they being caſt with arms, or united to binders, in order to take a firm hold on the maſonry, and become a permanent ſupport; the ſegment thus paſſing into the butments, might be conſidered as a part of the arch, which, by this means, would butt againſt the centre of the whole weight of the butment, and muſt puſh the whole away before the arch could yield; but, without this precaution, the arch would reſt ſo near the top of the butment, as to raiſe the ſtone-work and endanger the whole. Having thus prepared the butments, a centre of three or more ſegments, ſo that each ſtave may have two bearings, ſhould be